

COMPUTER BRAILLE CODE

Revised 2000

**Developed Under the Sponsorship of the
BRAILLE AUTHORITY OF NORTH AMERICA**

2000

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FOREWORD

As our society's dependence on computing technology grows, computers become increasingly important to the blind and visually impaired. Those who read braille in order to learn about computers and to communicate with them have an urgent need for a braille computer code that is unambiguous, and that makes possible the faithful transcription into braille of computer-related text in print. In 1972, BANA recognized this need by adopting The Provisional Braille Code for Computer Notation. It was a preliminary code that left many problems unsolved, but its adoption allowed braille readers and braille transcribers to accumulate a body of experience on which to base a more efficient code. The code presented and explicated in this volume has been made possible by that experience.

The Computer Braille Code utilizes the sixty-four combinations of dots that can be formed in the braille cell, and assigns to these dot patterns the same meanings assigned to them by North American manufacturers of computer braille equipment. However, an effective braille code must be capable of representing the 128 characters in the ASCII code, and must provide a few additional symbols that transcribers need in order to achieve faithful braille transcriptions. To meet these requirements, two meanings must be assigned to many of the sixty-four dot patterns, and a way of indicating the meaning that is intended must be provided. In the Computer Braille Code, the differentiation between the two meanings assigned to a dot pattern is accomplished by means of a prefix consisting of dots 456.

The Computer Braille Code Committee has studied a large and diverse sample of current computer materials, and has worked diligently to make the Computer Braille Code a realistic code, capable of unambiguous representation of current computer notation, but flexible enough to respond to changing and expanding needs. Feedback from braille readers, transcribers, and publishers has been solicited, and is reflected in this edition.

BANA and this Committee recognize that the code does not address important issues, such as the transcription of flow charts and graphics. However, we are pleased to publish it in its present form, and trust that a future revision will deal with such issues. We welcome suggestions and comments from the field.

BANA wishes to thank Dr. T. V. Cranmer (Chairman of the Computer Braille Code Committee), and Dr. Emerson Foulke, Mrs. Priscilla Harris, Miss Donna Pastore, Dr. Sandra Ruconich, Dr. Lawrence Scadden, and Mr. Joseph Sullivan (committee members), for their work.

FOREWORD TO THE 2000 EDITION

Since the 1987 publication of the Computer Braille Code, the use of the internet has become commonplace. This edition contains some new, internet-related examples which did not exist in 1987.

The numbering of rules and examples has changed to reflect the BANA document developed in 1998, SPECIFICATIONS FOR THE PRODUCTION OF BRAILLE AND PRINT PUBLICATIONS FOR THE BRAILLE AUTHORITY OF NORTH AMERICA. Each section stands alone, making future additions easier.

Section 3.6, the rule that deals with the placement of embedded computer notation, has been clarified to address the issue of where to begin a passage of embedded computer notation which requires more than one braille line.

The new examples and the clarified rule are listed on page ix, and an index has been added to the code for easier reference.

BANA COMPUTER TECHNICAL COMMITTEE

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**CHANGES AND CLARIFICATIONS
TO THE COMPUTER BRAILLE CODE IN 2000**

Example 1.3.1d changed

Example 1.7.2 new

Example 2.3.3 new

Example 2.3.6 new

Example 3.4.2 new

Example 3.5.1 new

Section 3.6 clarified rule

Example 3.6.3 new

Example 3.6.4 changed

Example 4.3.2 new

Example 6.3.2 new

Example 10.2.2 new

Example 11.2.2 new

Example 13.1.2 new

The Computer Braille Code is entered when precise representation is essential. Thus, material such as programs, program lines, computer commands, and filenames should be transcribed in Computer Braille Code. The following guidelines may be helpful in the identification of computer notation. Because languages and situations the transcriber may encounter will doubtless vary widely, these guidelines are offered merely as suggestions and not as all-inclusive, binding rules.

A: FORMAT.COM:MBASIC.COM:PIP.COM:ED.COM

Example 1.1.2: Dot Matrix Print

DOS READY

A dot matrix print representation of the text 'DOS READY'. Each character is formed by a 5x7 grid of dots. The 'D' is formed by dots at (1,1), (1,2), (1,3), (2,1), (2,2), (3,1), (3,2), (3,3), (4,1), (4,2), (4,3), (5,1), (5,2), (5,3). The 'O' is formed by dots at (1,4), (1,5), (1,6), (2,4), (2,5), (3,4), (3,5), (4,4), (4,5), (5,4), (5,5). The 'S' is formed by dots at (1,7), (1,8), (1,9), (2,7), (2,8), (3,7), (3,8), (4,7), (4,8), (5,7), (5,8). The 'R' is formed by dots at (1,10), (1,11), (1,12), (2,10), (2,11), (3,10), (3,11), (4,10), (4,11), (5,10), (5,11). The 'E' is formed by dots at (1,13), (1,14), (1,15), (2,13), (2,14), (3,13), (3,14), (4,13), (4,14), (5,13), (5,14). The 'A' is formed by dots at (1,16), (1,17), (1,18), (2,16), (2,17), (3,16), (3,17), (4,16), (4,17), (5,16), (5,17). The 'D' is formed by dots at (1,19), (1,20), (1,21), (2,19), (2,20), (3,19), (3,20), (4,19), (4,20), (5,19), (5,20). The 'O' is formed by dots at (1,22), (1,23), (1,24), (2,22), (2,23), (3,22), (3,23), (4,22), (4,23), (5,22), (5,23). The 'R' is formed by dots at (1,25), (1,26), (1,27), (2,25), (2,26), (3,25), (3,26), (4,25), (4,26), (5,25), (5,26). The 'E' is formed by dots at (1,28), (1,29), (1,30), (2,28), (2,29), (3,28), (3,29), (4,28), (4,29), (5,28), (5,29).

- 1.2 Program lines are generally relatively short and sometimes begin with numbers. Often these lines are indented in a systematic way which distinguishes them from mathematics or regular text.

Example 1.2.1: Short Program Lines Identified by Numbers

```

10 PRINT "HOW OLD ARE YOU?"
20 INPUT A
30 PRINT "THANK YOU!"
40 PRINT "YOU CAN RETIRE"
50 PRINT "IN" ; 65-A ; "YEARS."
60 END

```

A dot matrix print representation of the program code. Each line of code is indented by a fixed number of characters. The first line '10 PRINT "HOW OLD ARE YOU?"' is indented by 10 characters. The second line '20 INPUT A' is indented by 10 characters. The third line '30 PRINT "THANK YOU!"' is indented by 10 characters. The fourth line '40 PRINT "YOU CAN RETIRE"' is indented by 10 characters. The fifth line '50 PRINT "IN" ; 65-A ; "YEARS."' is indented by 10 characters. The sixth line '60 END' is indented by 10 characters.

```

for I := 1 to NoOfLines do
  begin
    Readln(Line);
    if Length(Line) < Limit then
      ShortLines := ShortLines + 1
    else
      LongLines := LongLines + 1
    end;
  end;

```

[illegible]

- 1.3 Comments sometimes explain what is happening in a program. These comments are frequently distinguished from surrounding material by characteristic symbols or words [e.g., /* ... */ , (* ... *) , REM, OUTPUT, etc.].

COMPUTER BRAILLE CODE

Example 1.3.1: Explanatory Comments (5-00)

- /* This is a comment in C */
- (* This is a comment in Pascal *)
- { So is this }
- 110 REM THIS IS A COMMENT IN BASIC

Note: These program lines are treated as embedded in the examples because of the identifying letters. In an actual program listing they would be in displayed notation, and the indicators would not be used.

Example 1.3.2: Explanatory Comments

{ Longest possible representation }

The figure consists of 10 small diagrams arranged horizontally, each showing a pattern of black dots on a grid. The patterns evolve from left to right, starting with a small cluster of dots and growing into a more complex, fractal-like structure. The diagrams are arranged in a single row, separated by spaces.

1.4 Words may be enclosed within quotation marks or angle brackets.

Example 1.4.1: Word Enclosed within Angle Brackets

<FILE>

- ### Example 1.5.1: Horizontal Sign of Comparison

- $$(ev \sim evNull) \Rightarrow$$

- ### Example 1.6.1: Superimposed Symbol

Note: The shape indicators enclose 2h1v to describe the shape consisting of two horizontal lines and one vertical line.

- ### Example 1.7.1: Words Out of Context

- bruce_r._fortnum@magic.ca

Note: This E-mail address contains underscore characters (456, 456) which are not represented in English Braille.

2.0 COMPUTER BRAILLE CODE SYMBOLS AND USAGE

- 2.1 The Computer Braille Code is based on ASCII (American Standard Code for Information Interchange), a code used by virtually all computer-related braille devices distributed in North America. Printable symbols from other codes (e.g., EBCDIC and BAUDOT) can also be represented using Computer Braille Code symbology. The Computer Braille Code makes communication with braille devices possible while simultaneously providing for the precise transcription of computer-related materials in braille. A table of Computer Braille Code symbols appears at the end of this code.
- 2.2 Although in certain instances many braille devices use one braille symbol to represent two different print characters (e.g., upper case A and lower case a are both brailled as dot 1), the Computer Braille Code avoids this ambiguity. Standard alphabetic characters (a-z) are used for lower case letters. The same symbols, preceded by dots 456, are used to represent upper case letters. Braille symbols used in this dual manner include single upper case (A) and lower case (a) letters, at sign (@) and grave accent (`), up arrow/circumflex (^) and tilde (~), left bracket ([) and left brace ({), right bracket (]) and right brace (}), and backslash (\) and vertical bar (|). The underscore symbol (_) has a separate identity.
- 2.3 The Computer Braille Code is a separate, secondary code, which may be used in conjunction with the primary code in which the text is transcribed—whether that code be English Braille, Braille Formats, Nemeth, or Braille Music. Material such as numbers, abbreviations, acronyms, contractions, and punctuation marks should be transcribed in this primary code unless there is good reason to enter Computer Braille Code. Thus, technical-appearing abbreviations and acronyms such as "IBM" and "ASCII" occurring within an English Braille transcription should be transcribed in English Braille. Computer Braille Code is entered when precise representation is essential; for this reason, Computer Braille Code material is transcribed character for character (i.e., no contractions are used), and the contractions to, into, and by may not be used before any Computer Braille Code indicator. Computer Braille Code numbers are transcribed in the lower two-thirds of the cell and are not preceded by number signs. Programs and other computer notation set off from the body of the text and computer input in which every letter must be typed precisely in the manner shown are examples of material which should be transcribed in Computer Braille Code. When in doubt, Computer Braille Code should be used. Likewise, the transcriber must also judge or seek advice as to the significance of vertical and horizontal spacing within the text. When in doubt, assume spacing is significant.

Example 2.3.1: Technical-Appearing Text (English Braille)

There were many complaints about the size of BCDIC, and IBM introduced Extended BCDIC with System/360.

There were many complaints about the size of BCDIC, and IBM introduced Extended BCDIC with System/360.

Example 2.3.2: Text with Embedded Computer Notation (English Braille and Computer Braille Codes)

The test criterion compares j to the term value (2) 3000 (!= tests for inequality).

The test criterion compares j to the term value (2) 3000 (!= tests for inequality).

Note: The (2) refers to a second item of previously discussed material.

Example 2.3.3: Text with Embedded Web Site Address (English Braille and Computer Braille Codes) (5-00)

Engine trouble? Know the difference between search engines and directories. Directories, such as Yahoo! Canada (www.yahoo.ca) and a2z (www.a2z.lycos.com), have lists of sites you can browse by subject.

Engine trouble? Know the difference between search engines and directories. Directories, such as Yahoo! Canada (www.yahoo.ca) and a2z (www.a2z.lycos.com), have lists of sites you can browse by subject.

```
struct nlist *np, *lookup();
char *strsave(), *alloc();
int hashval;
```

This number divided by $0FF_{16}$ is the fraction of the symbol table used.

Note: This example is in hexadecimal notation. In this notation, the numbers are the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, *and* the letters A, B, C, D, E, F. Therefore, the example shows the number 0FF not the word OFF.

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3.0 FORMAT

- 3.1 Computer Braille Code transcriptions should use the longest possible braille line allowed by production and duplication considerations. Current line length is typically 40 or 41 cells.
- 3.2 A transcriber's note at the beginning of each volume of a book should state the year of adoption of the Computer Braille Code, as well as the primary code in which the book is transcribed. If a book requires more than two codes, all codes employed should be listed. (For other information required on the Transcriber's Notes Page, see also 4.1, 10.2, 13.4, 14.1, and 14.2).
- 3.3 Symbols which the transcriber has devised or those assigned special usage should be explained or drawn on a "Special Symbols" page. These symbols should be transcribed in accordance with the rules of the Braille Formats Code. Neither standard Computer Braille Code symbols nor symbols of other adopted codes which are used in accordance with the rules of the applicable code(s) should be included on the "Special Symbols" page, except as may be required by applicable codes.
- 3.4 A blank line should precede and follow programs and computer notation set off from the body of the text. Transcription of such material should begin in cell 1 of the appropriate line, with runovers beginning in cell 2 of the following line(s). (See Sections 6.0, 7.0, and 9.0 for more information about runovers.)

Example 3.4.1: Computer Notation Set Off from Body of Text

The following JCL may be used when the above steps are complete, or as a third step of the above, to generate the compiler:

```
//LISP JOB
//STEP3 EXEC PGM=LISP
//STEPLIB DD DSNAME=LISP,VOLUME=SER=zzzzzz,UNIT=www,DISP=OLD
//LISPOUT DD SYSOUT=A
```

4.4 For 360/91 Users Only

Because of hardware differences on the IBM 360/91, the following update cards must be included during the assembly of ...

Figure 1 displays 36 small plots arranged in a 3x12 grid. Each plot shows a different spatial pattern of black dots on a white background. The patterns vary in density, shape, and arrangement, representing different spatial processes. The patterns are organized into three rows of 12 plots each. The first row shows patterns with varying densities and shapes, including clusters and elongated structures. The second row shows patterns with varying densities and shapes, including clusters and elongated structures. The third row shows patterns with varying densities and shapes, including clusters and elongated structures.

Contact Country Acres Seniors Community Ltd. for more information. The web site is given below.

<http://www.angelfire.com/biz/casc/index.html>

A 3x10 grid of dots forming a stylized representation of the word "MATHS". The dots are arranged in three rows and ten columns. The first row contains the letters 'M', 'A', 'T', 'H', 'S' in a stylized font. The second row contains the letters 'M', 'A', 'T', 'H', 'S' in a different stylized font. The third row contains the letters 'M', 'A', 'T', 'H', 'S' in a third stylized font.

- 3.5 Whenever possible, an entire computer program should be transcribed on a single braille page. When a program is too long to fit on a single page, any identifying label should be centered on the last line (usually line 25) of each page to which it applies. A program line cannot be divided between pages. Text following a program requiring more than one braille page should begin on a new page, with the transition to the new page replacing the blank line which ordinarily follows a program.

Example 3.5.1: Program with Identifying Label (5-00)

Program 3-5
 "Guess the Number" Program

```

% The "Guess the Number" program
% Chooses a random number between 1 and 99
% and allows you to guess it
randomize
var hidden, guess: int
var reply: string(1)
put "Guess the hidden number"
put "It is between 1 and 99 inclusive"
loop
  var count: int := 0
  put "Do you want to play? Answer y or n" ..
  get reply
  exit when reply = "n"
  % Choose a random number between 1 and 99
  randint (hidden, 1, 99)
  loop
    put "Enter your guess (any number between 1 and 99)" ..
    get guess
    count := count + 1
    if guess < hidden then
      put "You are low"
    elseif guess > hidden then
      put "You are high"
    else
      put "You got it in ", count, " guesses"
      exit
    end if
  end loop
end loop

```


The image displays a collection of black dots arranged in a structured, grid-like pattern on a white background. The dots are organized into several distinct clusters and patterns, including a large central cluster, a smaller cluster to the left, and a series of dots forming a horizontal line across the middle. The overall shape is roughly rectangular with a jagged right edge.

Figure 1 shows a 3x12 grid of dots. The first 10 columns contain a sparse pattern of dots, while the last two columns are entirely empty. The pattern of dots in the first 10 columns is as follows:

Column	Row 1	Row 2	Row 3
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			

- ### Example 3.6.1: Embedded Computer Notation

The macro command will change all occurrences of ROM to RAM. If used on the example in the "J" commands, the resulting line will read: WHEN IN RAM DO AS THE RAMANS DO, AND BE RAMANTIC...

A 6x10 grid of 60 small dot patterns, each representing a different 2D shape. The shapes are formed by black dots on a white background. The patterns include various polygons, stars, and abstract shapes, all rendered in a minimalist, pixelated style.

Example 3.6.3: Embedded Computer Notation (Web Site) with Runover (5-00)

A 10x10 grid of dots representing a sparse matrix. The dots are arranged in a pattern that suggests a banded or sparse structure, with many empty cells. The dots are black and the background is white.

4.1 Unless otherwise indicated, the Computer Braille Code assumes that letters and words contained in computer notation are lower case. When computer notation is predominantly or exclusively upper case (e.g., a BASIC text), the transcriber may elect to use single-cell letters to indicate upper case and letters preceded by dots 456, the shift indicator, to designate lower case. If computer notation throughout a text is exclusively upper case, a transcriber's note to this effect should appear on the "Transcriber's Notes" page. (Examples 1.1.2, 1.2.1, 1.3.1d, 1.4.1, 1.7.1, 5.1.1, 6.3.1, 8.1.1, 9.1.1, and 14.2.1 would include such a note.) If computer notation throughout a text is not exclusively upper case, the transcriber's note should immediately precede the material to which it applies.

```
10 INPUT "YOUR FIRST NAME";A$
20 INPUT "YOUR MIDDLE NAME";B$
30 INPUT "YOUR LAST NAME";C$
```

Figure 1 shows a 3x10 grid of 30 dot patterns. Each pattern is a 3x3 grid of dots. The patterns are arranged in three rows and ten columns. The first row contains patterns 1-10, the second row contains patterns 11-20, and the third row contains patterns 21-30. The patterns are designed to be read by a robot using a camera and a neural network.

The shift indicator precedes a single upper case letter appearing in embedded computer notation and/or computer notation set off from the body of the text which is otherwise in lower case. Two or more upper case letters occurring in predominantly lower case text—whether these letters appear consecutively or are separated by numbers, punctuation, etc.—must be preceded by the caps lock indicator (see Section 4.3.).

Example 4.3.1: Consecutive and Single Upper Case Letters

UNDEFINED; \$(Implementation detail)

Example 4.3.2: Case Designation in E-mail Addresses (5-00)

Usually letters in e-mail addresses are all in lower case; however an address on one list is Red2@netcom.ca.

The caps release indicator cancels the effect of the caps lock indicator.

Example 4.4.1: Caps Lock and Caps Release Indicators

VFUN PSTmsgToVec(ipcMsg

5.1 Control characters, whether in ASCII or other computer codes, are not actually printed by computers and are therefore symbolized in print in a variety of ways. For example, the carriage return function may be represented by "RETURN ," "ENTER ," "CR ," a downward left-curved arrow, a depicted key, or in various other ways. Thus, the braille transcription should follow the print symbology literally, in accordance with the other rules of this code.

```
) CREATE/I DSWITCH.CLI ←
```

Example 5.1.2: "Carriage Return" Representation

RETURN

6.1 Continuation Indicator $\begin{smallmatrix} \bullet & \bullet \\ \bullet & \bullet \end{smallmatrix}$ (456, 12346)

Example 6.1.1: Continuation Indicator

6.2 The remainder of the original print line is continued on the next braille line(s). Runovers of computer notation set off from the body of the text begin in cell 2. Runovers of embedded computer notation begin at the margin currently in effect in order to aid the scanning braille reader in distinguishing program from narrative.

- 6.3 A continuation indicator should be used when the entire print line will not fit on the braille line(s), even if the line division occurs following a complete word.

Example 6.3.1: Continuation Indicator within Embedded Computer Notation

12. Complete the following program, which is similar to that of frame 11. Use string variables for substrings to produce this display from \$Z = "THE END OF A STRING IS ON THE RIGHT."

```

:::  ::  :::::  :::::  ::  :::::  :::::  ::  ::
:::  :::  ::  ::  ::  :::::  :::::  :::::  :::
:::  :::  ::  ::  :::::  :::::  :::::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::

```

Example 6.3.2: Continuation Indicator within Embedded Web Site Address (5-00)

Most of these pages have a link to the *Saturday Night Live* sketch CNN relentlessly aired of Hartman impersonating President Clinton; you can download it directly from www.cnn.com/SHOWBIZ/TV/9805/28/hartman.obit/phil.hartman.43.3.8.mov.

```

:::  ::  :::::  :::::  ::  :::::  :::::  ::  ::
:::  :::  ::  ::  ::  :::::  :::::  :::::  :::
:::  :::  ::  ::  :::::  :::::  :::::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::  ::
:::  ::  ::  :::::  :::::  :::::  ::  ::  ::

```

7.0 INDENTED MATERIAL

- 7.1 When successive levels of indentation occur in print, braille lines should also be indented. Each braille level of indentation should begin two spaces to the right of the previous level, regardless of the print spacing used. Thus, successive levels of braille indentation begin in cells 1, 3, 5, etc. When in doubt, consider spaces at the left as levels of indentation, not countable spaces.
- 7.2 Runovers should always begin in cell 2, regardless of the current depth of indentation.

Example 7.2.1: Indented Material

```

results()    /* print table using array pointers */
{
    extern int *pA1,*pA2,*pA3;
    int i;
    printf("\n%10s%10s%10s%10s\n\n","i","A1[i]","A2[i]","A3[i]");
    for(i = 0;i <= MAX-1;i++)
        printf("%10d%10d%10d%10d\n",i, pA1[i],pA2[i],pA3[i]);
}

```

[illegible]

Example 7.2.2: Indented Material

```
UnionOrderPackage =
{ &CompareAB →
  (lambda (x y)
    (cond ((&MemberA x) (cond ((&MemberA y) (&CompareA x y))
                              (t -1)))
      ((&MemberA y) 1)
      (t (&CompareB x y))))}
```

Note: The symbol for the right-pointing arrow was selected from the Nemeth Code and enclosed within the shape indicators.

8.0 ISOLATED LOWER-CELL SIGNS

- 8.1 When a lower-cell sign is isolated (i.e., preceded and followed by a space or line end), dots 456 must immediately precede this sign. The lower-cell sign may be a single-digit number, quotation mark, apostrophe, comma, hyphen/minus sign, or semicolon. The resulting two-cell symbol signifies a single print character.

Example 8.1.1: Isolated Lower-Cell Signs

```
107 : CLEAR YLEN 0 DO XLEN 0 DO 0 I J UNIVERSE C! LOOP LOOP ;
```


9.0 COUNTABLE SPACES

9.1 Countable Spaces Indicator $\begin{smallmatrix} \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \\ \bullet & \bullet & \bullet \end{smallmatrix}$ (456), followed immediately by at least two full cells (123456, 123456)

The countable spaces indicator is used when any series of five or more spaces within a print line is significant (e.g., when specific material which is surrounded by spaces must begin on a particular space within a line). These significant spaces, which are important to an accurate understanding of the material being transcribed, are called countable spaces. The first and last spaces of a countable space sequence are transcribed as empty cells (i.e., spaces), with a countable spaces indicator filling the remainder of the spaces to be counted. Each cell of a countable spaces sequence counts as one space, as does each of the spaces surrounding it.

Example 9.1.1: Countable Spaces Indicator

```
110    REM      SORT AN ARRAY INTO DESCENDING ORDER.
120
130    DIM X(100)
```

Figure 1 displays a 3x10 grid of dot patterns, where each pattern represents a number from 0 to 29. The patterns are arranged in three rows and ten columns. The first row contains patterns for 0-9, the second row for 10-19, and the third row for 20-29. Each pattern is a unique arrangement of black dots on a 3x3 grid.

9.2 At least three full cells of the countable spaces indicator must appear on any runover line(s).

Example 9.2.1: Countable Spaces with Continuation Indicator

[illegible]

Example 9.2.2: Countable Spaces Beginning on Runover Line

```

6 : <A>      0 0 HERE 1+ CONVERT DROP DROP  ( extract variable # )
7           [COMPILE] LITERAL                ( make it a literal )
8           COMPILE <ADDR> ;                 ( dynamic part of address )
9 1 WIDTH !   ( set significant characters in name )
10 : @X      ( --- value ) ( fetch contents of variable X )

```

The image displays a 10x10 grid of 100 small 5x5 dot patterns. Each pattern is a unique configuration of 25 dots, representing a 25-dot Golomb ruler. The patterns are arranged in a grid that visually represents the structure of the ruler, with the total length of the ruler being 100 dots. The patterns are arranged in a grid that visually represents the structure of a 25-dot Golomb ruler, with the total length of the ruler being 100 dots.

10.1 Begin Emphasis Indicator ⋮⋮⋮ (456, 16)

End Emphasis Indicator ⋮⋮⋮ (456, 34)

Example 10.1.1: Emphasis Indicators

Example 10.1.2: Emphasis Indicators

&Hdddd where dddd is a 1 to 4 digit sequence composed of hexadecimal ...

- 10.2 When more than one type style is used to emphasize technically significant material, a transcriber's option symbol should begin emphasis and a termination indicator should end emphasis in each case. A transcriber's note should explain the use of transcriber's option symbols. (See Section 14.0 for a discussion of transcriber's option symbols and Section 16.0 for a discussion of the termination indicator.)

Example 10.2.1: Emphasis Indicators with More Than One Type Style

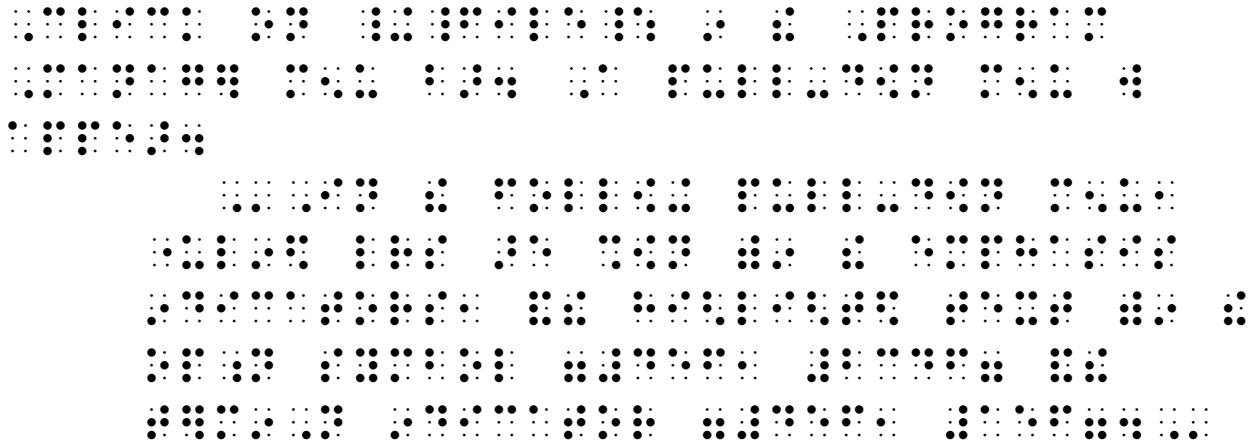
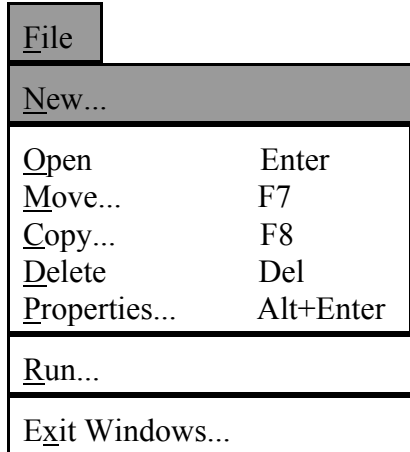
```
enter<imp>  
do  
    imp ○> 'restart' lab;  
    'leave' lab ○> imp;  
exit<imp>  
#)
```

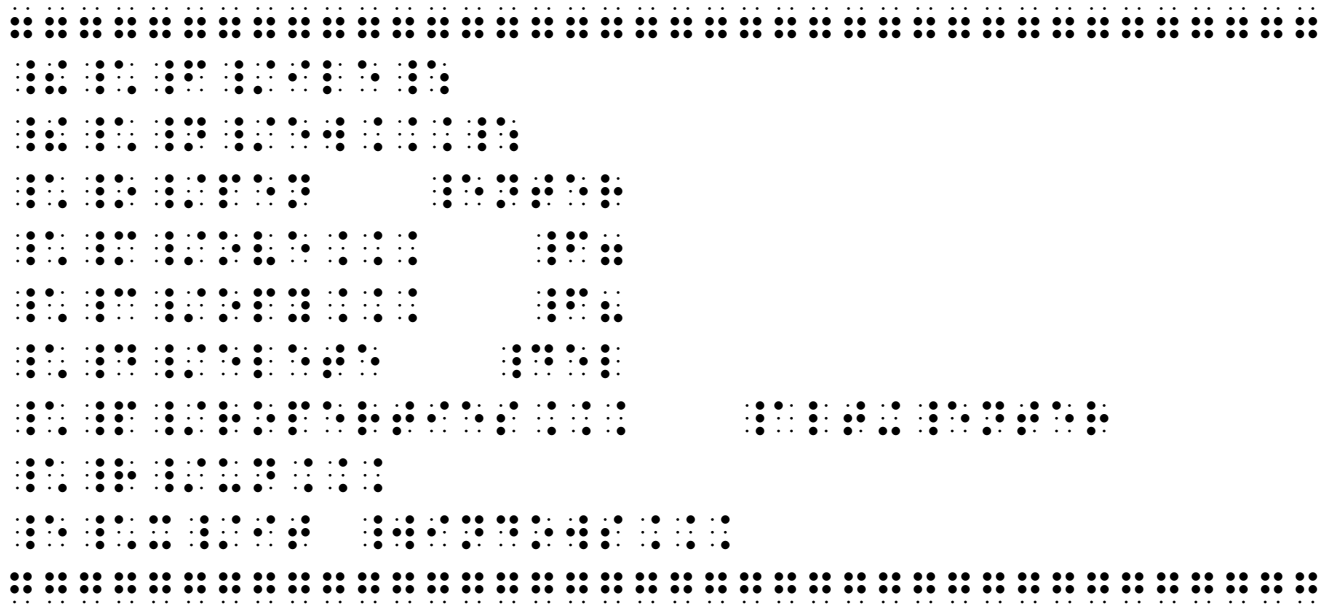
A collection of 100 Braille characters arranged in a grid. The characters are formed by combinations of dots 1 through 6, showing various patterns and sequences. The grid is organized into 10 rows and 10 columns, with each character occupying a single cell. The characters include simple patterns like a single dot, two dots, and three dots, as well as more complex patterns involving all six dots.

Note: The symbol for the circle was selected from the Nemeth Code and enclosed within the shape indicators.

Example 10.2.2: Emphasis Indicators with More Than One Type Style (5-00)

Click on **File** in the Program Manager menu bar. A pull-down menu will appear.





Note: Since guide dots and empty column fill are not represented in the Computer Braille Code, print column form is not maintained. Where items are present in column 2 they are separated from items in column 1 by 3 spaces.

11.1 Begin Computer Braille Code Indicator ⠠⠠⠠ (456, 346)

End Computer Braille Code Indicator ⠞⠼⠶⠺ (456, 156)

Computer Braille Code indicators need not enclose computer notation set off from the body of the text. Computer Braille Code should be entered when textual passages include obvious computer notation (e.g., material to be typed to the computer by the reader in a specific manner).

- 11.2 If the caps lock indicator, the begin emphasis indicator, the begin Nemeth Code indicator, or the begin shape indicator begins embedded Computer Braille Code, the begin Computer Braille Code indicator need not be used; however, the end Computer Braille Code indicator must always be used to signal a return to regular text. The purpose of Computer Braille Code indicators is to clarify potentially ambiguous situations (e.g., the character preceding s in the filename item.s could be either a period or part of the "less" sign). Frequent switches between Computer Braille Code and the primary code being used should be avoided, particularly within the same braille line. Thus, unless a row or column of a table, a title, or other contiguous material can be transcribed entirely in the primary code, Computer Braille Code should be employed.

Example 11.2.1: Computer Braille Code Indicators

... the symbols of the form *1, *2, etc.

The figure shows a sequence of 10 diagrams, each representing a 5x5 grid of dots. The dots are black, and the background is white. The sequence shows a pattern of dots that evolves from left to right. The first diagram has a small cluster of dots in the top-left corner. As the sequence progresses, more dots are added, forming a larger, more complex shape that includes several connected components and some isolated dots. The final diagram shows a pattern that is roughly rectangular with some internal structure.

Example 11.2.2: Computer Braille Code Indicators (5-00)

An e-mail address which uses upper case letters is ROGERJ@east.cnib.ca.

Figure 1 displays a set of 26 dot patterns arranged in two rows of 12. The top row contains the digits 0 through 9, and the bottom row contains the letters A through Z. Each pattern is a 3x4 grid of dots, where the presence or absence of a dot at a specific position represents a binary value (0 or 1) for that character.

... the symbols of the form *1 and *2, etc.

item.s

[illegible]

Note: This example appeared within the body of the text. Had the computer notation been set off from the body of the text, Computer Braille Code indicators would have been unnecessary.

12.0 NEMETH CODE INDICATORS

12.1 Begin Nemeth Code Indicator ⠠⠠ (456, 146)

End Nemeth Code Indicator ⠠⠠ (456, 156)

Nemeth Code may be necessary when purely mathematical expressions (e.g., formulas, equations, the multiplication symbol when represented by a dot, etc.) are to be transcribed or when no appropriate Computer Braille Code symbol exists (e.g., there is no horizontal fraction indicator in Computer Braille Code). However, Nemeth Code should be resorted to only rarely, and a Nemeth Code expert should be consulted before the transcription is undertaken. If frequent use of Nemeth Code seems necessary, the primary code in which the text is transcribed may need to be changed.

Example 12.1.1: Nemeth Code Indicators

Mathematical Notation	BASIC Notation
$a_1 + a_2 + a_3 + a_4$	A(1)+A(2)+A(3)+A(4)
$x_1^2 + x_2^2$	X(1) ^ 2+X(2) ^ 2
$(a-r_1) (z-r_2)$	(A-R(1))* (Z-R(2))
$1.5(z_{i+1}-z_i)$	1.5*(Z(I+1)-Z(I))

13.1 Begin Shape Indicator (456, 1246)

End Shape Indicator  (456, 156)

Example 13.1.1: Shape Indicators

$$S \boxminus R = \llbracket \langle s, \text{add} \rangle \mid s \in S - R \rrbracket$$

Note: The shape for the square with an interior minus was transcribed as an s followed by a minus and enclosed within the shape indicators. The left and right double-barred brackets were transcribed as lb and rb within the shape indicators.

Example 13.1.2: Shape Indicators (5-00)

To access the scheduler, click on the icon in the Anti-Virus Toolkit window.

13.2 When keys on a computer keyboard are depicted, the begin shape indicator should be followed by the letter k, the key legend, and the end shape indicator.

Example 13.2.1: Depicted Key

Hit ENTER key.

The figure consists of 10 small diagrams arranged in a single row, each showing a pattern of black dots on a grid. The patterns evolve from left to right. The first diagram shows a small cluster of dots. The second diagram shows a more complex shape. The third diagram shows a larger cluster. The fourth diagram shows a more complex shape. The fifth diagram shows a larger cluster. The sixth diagram shows a more complex shape. The seventh diagram shows a larger cluster. The eighth diagram shows a more complex shape. The ninth diagram shows a larger cluster. The tenth diagram shows a more complex shape.

- 13.3 Transcribers familiar with Nemeth Code may select or devise symbols in accordance with Nemeth Code conventions, thus enhancing consistency among braille codes.

Example 13.3.1: Use of Nemeth Code Symbol of Shape within Shape Indicators

Characters existing only in the 'A' set:

& # % □ @

Equivalent characters from ...

Figure 1 shows a sequence of seven 5x5 dot patterns. Each pattern consists of black dots on a white background. The patterns are arranged horizontally and represent a sequence of states. The first pattern has 10 dots. The second has 12 dots. The third has 14 dots. The fourth has 16 dots. The fifth has 18 dots. The sixth has 20 dots. The seventh has 22 dots. The patterns show a progression from a sparse initial state to a more complex, structured state.

Note: The symbol for the square was selected from the Nemeth Code and enclosed within the shape indicators.

- 13.4 A transcriber's note at the beginning of the work or immediately prior to the first use of shape indicators should explain the symbol's meaning (if known), or its shape should be described or drawn. (See Example 13.1.2.)

14.1 Primary Transcriber's Option Symbol ⠠⠠⠠⠠ (456, 2346)

Secondary Transcriber's Option Symbol ⋮⋮ (456, 46)

When a character not represented by the Computer Braille Code occurs in a transcription with great frequency, the transcriber may use a transcriber's option symbol to represent that character. The minimum number of spaces required to produce the character is thus reduced from five to two. Transcriber's option symbols should be explained in a transcriber's note.

Example 14.1.1: Transcriber's Option Symbol Representing Non-ASCII Character (b)

```
RENAMEbfilename1[/ext1][.psw][:d]bTObfilename2[/ext2]
```

14.2 When the print text does not include a character used by the Computer Braille Code but does include a character not represented by the Computer Braille Code, the meaning of an unused Computer Braille Code character may be changed during that transcription (e.g., in an EBCDIC transcription, the unused Computer Braille Code tilde could represent the frequently used EBCDIC "not" sign). A transcriber's note should explain such substitutions.

Example 14.2.1 Transcriber's Substitution (ASCII Tilde Becomes EBCDIC "Not" Sign)

$$EX = (P \neq \text{NULL});$$

15.0 HALF-LINE SHIFTS

15.1 Half-Line Shift Up $\overset{\cdot\cdot}{\underset{\cdot\cdot}{\cdot\cdot}}$ (456, 3456)

Half-Line Shift Down $\underset{\cdot\cdot}{\overset{\cdot\cdot}{\cdot\cdot}}$ (456, 1456)

End Half-Line Shift $\overset{\cdot\cdot}{\underset{\cdot\cdot}{\cdot\cdot}}$ (456, 156)

Half-line shifts up represent superscripts—and in some cases exponentiation—which typically appear within text. If exponentiation within text is indicated by the up arrow, the up arrow symbol (dots 45 $\overset{\cdot\cdot}{\cdot\cdot}$) should be transcribed. Half-line shifts up terminate either with a termination indicator (see Section 16.0) or at the next space. When the superscript is not followed immediately by a space, the termination indicator must be used.

15.2 Half-line shifts down are used for transcribing subscripts and expressions in which the number base appears below normal line level. Half-line shifts down terminate either with a termination indicator (see Section 16.0) or at the next space. When the subscript is not followed immediately by a space, the termination indicator must be used.

7.2.2 Data Initialization Statement. A data initialization statement is of the form:

where:

-

... A listener may set NDAC low (shown between t_5 and t_6) but, it must do so before NRFD is set high at t_6 .

- 15.3 Reference indicators designating footnotes are transcribed in the primary code being used, not as half-line shifts up.

Example 15.3.1: Reference Indicator (English Braille)

This chapter discusses the use of the Pascal* subsystem that operates under the environment ...

*At least 160K bytes of main storage are required to install and use DOS Pascal.

This chapter discusses the use of the Pascal* subsystem that operates under the environment ...
 *At least 160K bytes of main storage are required to install and use DOS Pascal.

Example 15.3.2: Reference Indicator (Nemeth Code)

```
10 PRINT
20 PRINT3
99 END
```

RUN⁴

4. If you are not using an interactive system, ignore the word RUN shown before each output.

This chapter discusses the use of the Pascal* subsystem that operates under the environment ...
 *At least 160K bytes of main storage are required to install and use DOS Pascal.

16.1 Termination Indicator $\begin{smallmatrix} \bullet & \bullet \\ \bullet & \bullet \end{smallmatrix}$ (456, 156)

Example 16.1.1: Termination Indicator

To retrieve the file, use the command <code>get sandy, d2</code>	Return
--	--------

COMPUTER BRAILLE CODE SYMBOLS: ASCII ORDER

Note: Upper case letters may be transcribed as shown in the table, preceded by dots 456, or preceded by the caps lock indicator; applicable Computer Braille Code rules determine transcription method.
 "Reserved" designates currently unassigned symbols which are reserved for future use.

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
			space
!	⠁	2346	exclamation point
"	⠆	5	quotation marks, double quotes
#	⠏	3456	number sign, pound sign (weight)
\$	⠒	1246	dollar sign
%	⠒	146	percent sign
&	⠓	12346	ampersand
'	⠆	3	apostrophe, single quote
(	⠒	12356	left parenthesis
)	⠒	23456	right parenthesis
*	⠒	16	asterisk, multiplication sign

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
+	⠠⠨	346	plus sign
,	⠠⠨	6	comma
-	⠠⠨	36	hyphen, minus sign
.	⠠⠨	46	period, decimal point
/	⠠⠨	34	slash, division sign
0	⠠⠨	356	0
1	⠠⠨	2	1
2	⠠⠨	23	2
3	⠠⠨	25	3
4	⠠⠨	256	4
5	⠠⠨	26	5
6	⠠⠨	235	6
7	⠠⠨	2356	7

CBC SYMBOLS: ASCII ORDER

55

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
8	⠠	236	8
9	⠡	35	9
:	⠆	156	colon
;	⠆⠨	56	semicolon
<	⠨⠆	126	less than
=	⠠⠠	123456	equals
>	⠨⠡	345	greater than
?	⠠⠨	1456	question mark
@	⠠⠨⠠	4	at
A	⠠	1	A
B	⠠⠨	12	B
C	⠠⠨⠨	14	C
D	⠠⠨⠨⠨	145	D
E	⠠⠨⠨⠨⠨	15	E

COMPUTER BRAILLE CODE

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
F		124	F
G		1245	G
H		125	H
I		24	I
J		245	J
K		13	K
L		123	L
M		134	M
N		1345	N
O		135	O
P		1234	P
Q		12345	Q
R		1235	R
S		234	S

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
T		2345	T
U		136	U
V		1236	V
W		2456	W
X		1346	X
Y		13456	Y
Z		1356	Z
[		246	left bracket
\		1256	backslash
]		12456	right bracket
↑		45	up arrow/caret
—		456, 456	underscore
`		456, 4	grave accent

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
a		1	a
b		12	b
c		14	c
d		145	d
e		15	e
f		124	f
g		1245	g
h		125	h
i		24	i
j		245	j
k		13	k
l		123	l
m		134	m
n		1345	n

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
o		135	o
p		1234	p
q		12345	q
r		1235	r
s		234	s
t		2345	t
u		136	u
v		1236	v
w		2456	w
x		1346	x
y		13456	y
z		1356	z
{		456, 246	left brace
		456, 1256	vertical bar

COMPUTER BRAILLE CODE

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
}	⠼⠼⠼	456, 12456	right brace
~	⠼⠼	456, 45	tilde

Additional Computer Braille Code Symbols

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
	⠼⠼⠼	456, 2346	transcriber's option symbol
	⠼⠼	456, 46	transcriber's option symbol
	⠼⠼⠼	456, 3456	half-line shift up
	⠼⠼⠼	456, 1456	half-line shift down
	⠼⠼⠼	456, 156	end half-line shift
	⠼⠼⠼	456, 1246	begin shape indicator
	⠼⠼⠼	456, 156	end shape indicator
	⠼⠼⠼	456, 346	begin Computer Braille Code
	⠼⠼⠼	456, 156	end Computer Braille Code

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
	⠠⠠	456, 146	begin Nemeth Code
	⠠⠡	456, 156	end Nemeth Code
	⠠⠢	456, 12346	continuation indicator
	⠠⠣	456, 12356	reserved
	⠠⠤	456, 23456	reserved
	⠠⠥	456, 123456	reserved
	⠠⠦	456, 16	begin emphasis
	⠠⠧	456, 34	end emphasis
	⠠⠨	456	shift indicator, isolated lower-cell indicator
	⠠⠩	456, 345	caps lock indicator
	⠠⠪	456, 126	caps release indicator
	⠠⠫⠠⠫	(space) 456, 123456, 123456, ... (space)	countable spaces indicator

COMPUTER BRAILLE CODE SYMBOLS: BRAILLE ORDER

Note: Upper case letters may be transcribed as shown in the table, preceded by dots 456, or preceded by the caps lock indicator; applicable Computer Braille Code rules determine transcription method.

"Reserved" designates currently unassigned symbols which are reserved for future use.

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
			space
A or a	⠁	1	A or a
B or b	⠃	12	B or b
C or c	⠉	14	C or c
D or d	⠙	145	D or d
E or e	⠑	15	E or e
F or f	⠥	124	F or f
G or g	⠭	1245	G or g
H or h	⠓	125	H or h
I or i	⠏	24	I or i
J or j	⠗	245	J or j
K or k	⠕	13	K or k

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
L or l	⠠	123	L or l
M or m	⠡	134	M or m
N or n	⠢	1345	N or n
O or o	⠣	135	O or o
P or p	⠤	1234	P or p
Q or q	⠥	12345	Q or q
R or r	⠦	1235	R or r
S or s	⠧	234	S or s
T or t	⠨	2345	T or t
U or u	⠩	136	U or u
V or v	⠪	1236	V or v
X or x	⠬	1346	X or x
Y or y	⠭	13456	Y or y
Z or z	⠯	1356	Z or z

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
&	⠠	12346	ampersand
=	⠠	123456	equals
(	⠠	12356	left parenthesis
!	⠠	2346	exclamation point
)	⠠	23456	right parenthesis
*	⠠	16	asterisk, multiplication sign
<	⠠	126	less than
%	⠠	146	percent sign
?	⠠	1456	question mark
:	⠠	156	colon
\$	⠠	1246	dollar sign
]	⠠	12456	right bracket
\	⠠	1256	backslash
[	⠠	246	left bracket

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
W or w		2456	W or w
1		2	1
2		23	2
3		25	3
4		256	4
5		26	5
6		235	6
7		2356	7
8		236	8
9		35	9
0		356	0
/		34	slash, division sign
+		346	plus sign
#		3456	number sign, pound sign (weight)

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
>		345	greater than
'		3	apostrophe, single quote
-		36	hyphen, minus sign
@		4	at
↑		45	up arrow/caret
		456	shift indicator, isolated lower-cell indicator
A		456, 1	A
B		456, 12	B
C		456, 14	C
D		456, 145	D
E		456, 15	E
F		456, 124	F
G		456, 1245	G

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
H		456, 125	H
I		456, 24	I
J		456, 245	J
K		456, 13	K
L		456, 123	L
M		456, 134	M
N		456, 1345	N
O		456, 135	O
P		456, 1234	P
Q		456, 12345	Q
R		456, 1235	R
S		456, 234	S
T		456, 2345	T
U		456, 136	U

CBC SYMBOLS: BRAILLE ORDER

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<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
V	⠠⠧	456, 1236	V
X	⠠⠭	456, 1346	X
Y	⠠⠽	456, 13456	Y
Z	⠠⠵	456, 1356	Z
	⠠⠠	456, 12346	continuation indicator
	⠠⠠⠠	456, 123456	reserved
	⠠⠠⠠⠠	(space) 456, 123456, 123456, ... (space)	countable spaces indicator
	⠠⠠⠠⠠⠠	456, 12356	reserved
	⠠⠠⠠⠠⠠⠠	456, 2346	transcriber's option symbol
	⠠⠠⠠⠠⠠⠠⠠	456, 23456	reserved
	⠠⠠⠠⠠	456, 16	begin emphasis
	⠠⠠⠠⠠⠠	456, 126	caps release indicator

COMPUTER BRAILLE CODE

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
	⠠⠠⠠	456, 146	begin Nemeth Code
	⠠⠠⠠⠠	456, 1456	half-line shift down
	⠠⠠⠠⠠⠠	456, 156	termination indicator
	⠠⠠⠠⠠⠠⠠	456, 156	end Computer Braille Code
	⠠⠠⠠⠠⠠⠠⠠	456, 156	end Nemeth Code
	⠠⠠⠠⠠⠠⠠⠠⠠	456, 156	end shape indicator
	⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 156	end half-line shift
	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 1246	begin shape indicator
}	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 12456	right brace
	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 1256	vertical bar
{	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 246	left brace
W	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 2456	W
	⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠⠠	456, 34	end emphasis

<u>Print</u>	<u>Braille</u>	<u>Dots</u>	<u>Meaning</u>
	⠠⠠⠠	456, 346	begin Computer Braille Code
	⠠⠠⠠	456, 3456	half-line shift up
	⠠⠠⠠	456, 345	caps lock indicator
`	⠠⠠⠠	456, 4	grave accent
~	⠠⠠⠠	456, 45	tilde
_	⠠⠠⠠	456, 456	underscore
	⠠⠠⠠	456, 46	transcriber's option symbol
.	⠠⠠	46	period, decimal point
"	⠠⠠	5	quotation marks, double quotes
;	⠠⠠	56	semicolon
,	⠠⠠	6	comma

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